

contains from 1 to about 25 parts of a plasticizer per 100 parts by weight of the halogen-containing vinyl polymer. A flexible PVC composition contains from about 25 to about 100 parts of the plasticizer per 100 parts by weight of the halogen-containing vinyl polymer. Alkyl esters of carboxylic acids in which there are from 1 to 3 alkyl groups having from 8 to 12 carbon atoms are representative of the plasticizers. The alkyl group may be n-octyl, 2-ethylhexyl, nonyl, decyl, or dodecyl. Suitable esters include phthalates, trimellitates, benzoates, adipates, glutarates, and sebacates. The plasticizer may also be a pentaerythritol or such an ester thereof. A polymeric plasticizer is also suitable. For the purposes of this invention, all of the halogen-containing polymer compositions are classified in the same way as rigid, semi-rigid, and flexible.

As used herein, a hydrocarbyl radical contains from 1 to 20 carbon atoms and may be an alkyl, cycloalkyl, aryl, arylene, alkaryl, aralkyl, or an aralkenyl or alkenyl radical having up to 3 ethylene double bonds; likewise, said radicals constitute the hydrocarbyl portion of a hydroxyhydrocarbyl radical. As used herein: a monovalent radical has but one valence available for combining with another radical whereas a divalent radical may combine with two other radicals; the term alkyl represents monovalent straight or branched chain hydrocarbon radicals; the term alkylene represents divalent, trivalent, and tetravalent straight or branched chain hydrocarbon radicals; the term oxyalkylene represents a divalent radical of a polyalkylene ether molecule having a polyalkoxy chain of from 2 to 4 of such radicals, wherein the alkylene moiety has 2 or 3 carbon atoms.

Also, as used herein: an acyloxyalkyl radical originates

from a carboxylic acid ester of an alkyl alcohol; the R¹ radical in Formula 1 below, therefore, in the stearic acid ester of mercaptopropanol is the stearyloxypropyl radical; likewise, the R¹ radical of the oleic acid ester of mercaptopropanol, which is one of the tallate esters of that alcohol, is the oleoyloxypropyl radical. The R¹ radical of lauryl-3-mercaptopropionate, on the other hand, is dodecyloxycarbonylethyl.

The phrase "parts per hundred parts of resin is abbreviated herein as "phr". Also, as used in this invention, substantially means largely if not wholly that which is specified but so close that the difference is insignificant.

The stabilizer compositions of this invention comprise from about 25 % to about 99.5%, preferably from about 93.5 % to about 97.5 % of a latent mercaptan, from 0.5 to about 75% of a synergistic mixture of zinc chloride and zinc carboxylate, based on the total weight of the stabilizer composition, with or without a co-stabilizer selected from the group consisting of an epoxy compound and an organic phosphite, and with or without other metallic-based stabilizers, as defined hereinbelow, or other conventional non-metallic stabilizers. The stabilizer compositions of this invention are particularly suited to impart both good early color and superior long term stabilization against the deteriorative effects of heat and ultra-violet light on both rigid and flexible PVC resins and other halogen-containing polymers in comparison with the separate use of zinc chloride and zinc carboxylate as previously done in the art. They may be prepared by blending the components thereof in any convenient manner which produces a homogeneous mixture, such as by shaking or stirring in a container. It is advantageous

to add the zinc chloride in the form of a concentrated aqueous solution, e.g., about 50% by weight. Likewise, the stabilizer compositions of this invention can be incorporated in a halogen-containing polymer by admixing the components of the stabilizer composition and of the polymer composition, such as, for example, in an appropriate mill or mixer or by any other of the well-known methods which provide uniform distribution of the stabilizer throughout the polymer composition.

One of the advantages of this invention is that the offensive odor of mercaptans is masked by a blocking group so that the latent mercaptan thus created may be put into a PVC composition or the like with little or no offense to the operator with the knowledge that the free mercaptan will be released as a degradation product when the treated composition is heated during processing, e.g. extrusion and injection molding.

The compounds used for blocking the mercaptan group in the latent mercaptans of this invention are preferably those which are capable of furnishing a stabilized carbocation having a molecular structure in which the electron deficiency is shared by several groups. Resonance stabilization and neighboring group stabilization are two of the possible mechanisms by which the carbocations may be stabilized.

The mercaptan-containing organic compounds which may be converted into latent mercaptans for the purposes of this invention are well-known compounds and include alkyl mercaptans, mercapto esters, mercapto alcohols, and mercapto acids. See, for example, U.S. Pat. Nos. 3,503,924 and 3,507,827. Alkyl mercaptans having from 1 to about 200 carbon atoms and from 1 to 4 mercapto groups are suitable.